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Within the framework of nuclear accident scenarios, the initial contamination of continental hydrosystems is essentially from surface deposition of atmospheric aerosols. Whereas the deposition velocities were recently widely studied for meadows, forest and urban forest canopies, the aerosol deposits on hydrosystems need more specific investigations. The present work concerns the first step of a study on the mechanisms of dry deposition of sub-micro aerosol on continental hydrosystems (rivers, lakes and wetlands). As the spectrum of aerosols emitted during a nuclear accident is estimated to be centred around sub-micro particles, the objective of this work is to analyse dry deposition mechanisms on surface water, initially for particles close to 0.2µm.

Wind tunnel measurements of particle dry deposition were made to estimate the deposition rates due to water surfaces. The subsonic wind tunnel is a closed-circuit with an air vein (0.28m x 0.64m x 8.65m) seeded with a controlled aerosol emission. The water surface consists in a top full water tank (0.64m x 0.70m) to avoid the steps phenomena. This water tank is inserted in the bottom of the wind tunnel at 4.10m downstream from the vein entry, so that a fully turbulent flow is developed at the test section over the tank. Aerosols of fluorescein are emitted during 2 or 5min and homogeneously dispersed by a transversal copper pipe containing holes along the width of the air vein. The size distribution of the fluorescein was analysed with SMPS (Scanning Mobility Particle Sizer). The spectroscopic analysis gives diameter particles with a mean of 0.2µm (±0.1µm). The flow conditions are characterised by a LDV (Laser Doppler Velocimetry) technique. Humidity and temperature conditions are given by Pico PT-100 sensors. The concentration of aerosols in air is obtained by sampling on filter (Whatman filters) at regulars intervals during experiment. For water concentration, the solution in the tank is homogenized and a sample is withdrawn by syringe at regulars intervals during the experiment. Fluorescein concentrations of water sample are measured with a Spectrofluorimeter UV. The deposition velocities are deduced from these different fluorescein concentrations in air and water. When the flow conditions of the wind tunnel are changed by increasing the air velocity, some waves develop on the water surface. In order to find the significant wave height a capacitive sensors are used. Four times the standard deviation of the oscillation amplitude of the signal represents the significant wave height.

Deposition and waves were examined for wind speeds between 1 and 10m.s^{-1}. The friction velocity increased proportionally with the wind speed.

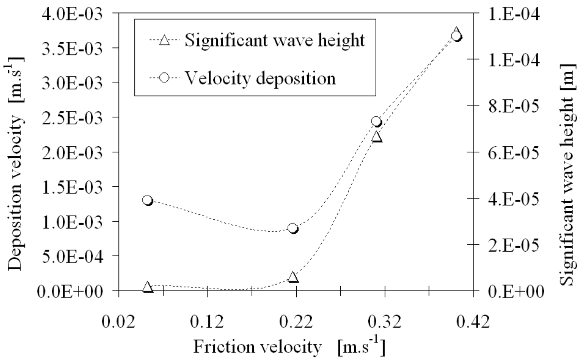

Figure 1 : Significant wave height and deposition velocity function versus friction velocity

Two parts are highlighted in the results (Figure 1). When friction velocity increased from 0 to 0.19m.s^{-1}, the deposition velocity decreased slowly. After 0.19m.s^{-1}, deposition velocity increased as the significant wave height. From the model by Williams (1981), the first part can be explained by a decrease in Brownian diffusion due to the air/water boundary conditions. In the second part, the velocity deposition on water increased due to the effect of the significant wave height on inertial impaction and diffusion. These results generally agree with Zufall et al. (1999) predictions in neutral and unstable conditions.

These results will be used to build a first mechanistic model with the intention of extending to atmospheric conditions.

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Zufall, M.J., Dai, W., Davidson, C.I. (1999). *Dry deposition of particles to wave surfaces: II. Wind tunnel experiments*. Atmospheric Environment, 33, 4283-4290.